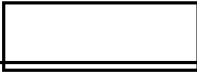
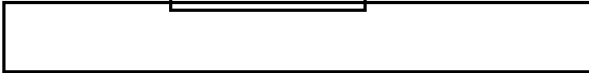


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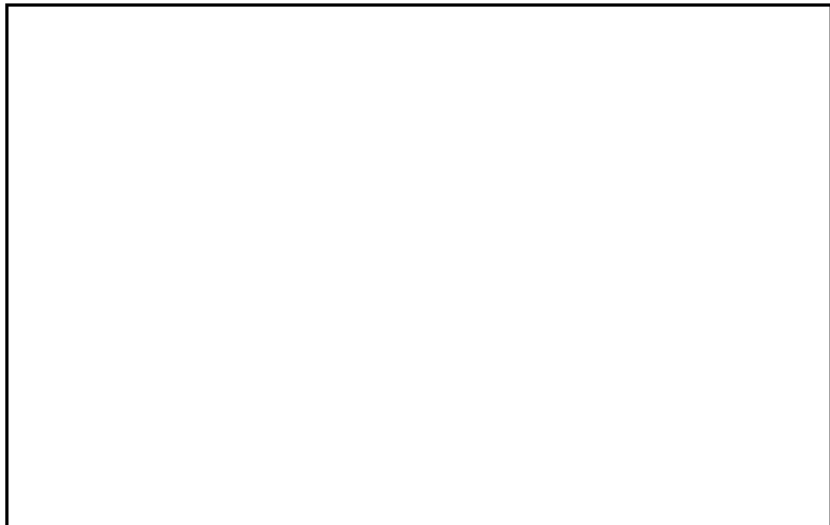
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NIMA/DOD

MANUAL
OPERATION AND MAINTENANCE
9-1/2 INCH PROTOTYPE  PROCESSOR
CONTRACT 

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April 1969



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FOREWORD

The information contained in this manual is based on the experience gained during the evaluation test program

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SECTION 1

INTRODUCTION AND DESCRIPTION

1.1 INTRODUCTION

This brochure is issued as basic operation and maintenance instructions for the 9-1/2 inch prototype [redacted] processor, designed and built to Technical Proposal [redacted] under the authorization of Phase II of contract [redacted]

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1.2 The equipment is designed to fully process 70mm to 9-1/2 inch aerial reconnaissance negative film [redacted] and positive duplicating film [redacted] as specified in Table 1-1 of Prototype Specifications.

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1.3 LEADING PARTICULARS

Significant particulars of the processor are listed in Table 1-1. A magazine is provided at the load end of the processor. The film path is a straight path through the splice box, wet section modules, and serpentine through the dryer, onto the main transport vacuum drive roller at the opposite end of the processor. The film is taken up from the vacuum drive roller onto a standard spool synchronously driven through a friction clutch. The power required is divided into two sections and is fed into the load and dryer sections of the processor. All circuit controls are located on two panels at the takeup end of the processor.

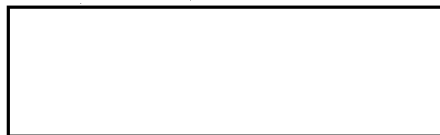
TABLE 1-1
9-1/2 INCH
PROTOTYPE SPECIFICATIONS

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The processor is designed to meet the following performance specifications:

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1. Film Types
Negative Film
Positive Duplicating



2. Film Widths

70mm and 9-1/2 inches.
Other film widths may be processed between 70mm and 9-1/2 ins. but spool shafts and splice plates are not provided.

3. Film Capacity

Load magazine and takeup spools to accommodate rolls of 70mm and 9-1/2 Ins. film up to 500 feet in length.

4. Temperature Control

Fixed processing temperature 110°F, variable 85°F to 120°F.

5. Maximum Processing

500 feet at a maximum rate of 25 fpm for film

STAT

6. Operation

Daylight or darkroom.

7. Density

Density variation to be controlled to within 0.05 units at a nominal density of 1.0.

8. Transport Speed

Continuously variable from zero to 30 fpm.

TABLE 1-1 (Continued)
9-1/2 INCH
PROTOTYPE SPECIFICATIONS

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9. Transport Control

The transport speed is controlled by the vacuum roller, which is driven by a 1/20 hp gear reduction motor. A speed control unit is provided.

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10. Overall Dimensions

Length 10' - 6" without load magazine, with load magazine 11' - 0", 41 ins. wide, maximum height ins.

11. Power Requirements

- (a) Film Processor
- (b) Dryer

115/230 volts, 3 wire, 100 amps
115/230 volts, 3 wire, 50 amps

SECTION 2

PREPARATION FOR USE

2.1 UNPACKING

The processor is shipped, complete for operation except for protective wrapping and crating. After uncrating, remove protective wrappings and hold-downs from vacuum rollers, light tight air exhausts, etc. The magazine and takeup spools and shafts are wrapped separately and stowed in the processor. Casters are provided for ease of location and movement.

2.2 INSTALLATION

The processor may be wheeled to the area of operation, and checked to ensure that it is reasonably level. The drain connection may be connected by a hose to the nearest drain. Carefully remove all lint and dust accumulated during delivery, from the tanks, drain trough, dryer, electrical panels, etc. by means of an air hose. Connect to running water and wash out all tanks.

2.3 DESCRIPTION OF ESSENTIAL CONTROLS

1. A key locked compartment is provided on each side of the load end of the machine. See Figure 2-1. The main power supply cable enters the left side (facing the magazine) where the main remote controlled power contactors are located. In the compartment on the other side of the processor (see Figure 2-2) are located the switch circuit breakers for the tank control circuits, air blower, and auxiliary air duct heaters.

2. Two control panels are provided at the takeup end of the processor, one on each side of the vacuum drive roller. See Figure 2-3. The left hand side panel (facing the end of the machine) contains the following controls.

1. Solution temperature indicator °F.
2. Solution temperature readout selector
3. Film drive ON - OFF switch
4. Film speed controller
5. Film speed indicator FPM

The opposite side panel contains the following controls.

6. "Power ON" switch
7. "Process ON" switch
8. Five identical sets of controls, one for each of the wet sections, each consisting of:
 - a) Tank warm-up ON - OFF switch
 - b) "Warm Up" light
 - c) "Ready" light
 - d) "Liquid level low" warning light
 - e) Solution heater selector switch "Normal or Fast"
 - f) Dryer thermostat blower and heater switches.

3. Temperature Control Adjustments.- The temperature set-point of the solution in each tank can be pre-set by means of the screw driver adjustment provided at each tank thermostat or a pre-set 110°F temperature control system. See Figure 2-4 for location of thermostats.

4. Operational Checks.- The following operational checks should be made prior to processing film, to ensure satisfactory functioning of all systems.

1. Fill all tanks with clean water until water runs out of each tank overflow. See Figure 2-5.
2. Operate the "POWER" switch to "ON", check that the green light in the switch comes on.
3. Operate tank 1, tank 2, tank 3, tank 4, and tank 5 switches. The "ON" switch, "warm-up" lights (yellow) should illuminate.
4. If the liquid level in any tank is low, the red low level warning light will illuminate for the tank or tanks in this condition. The liquid levels should be topped up until warning light extinguishes.
5. When the processing solutions have reached the required pre-set temperature, the green "READY" lights should illuminate. After these indicators come "ON" the "PROCESS" switch may be operated to "ON", and the green light in the switch should illuminate.
6. When the "PROCESS" switch is operated to "ON", the air blower, vacuum pump, liquid bearing pumps, are switched into circuit.
7. Drier. The drier is comprised of a cabinet which is accessible from the front through a full-length plexiglass door. The compartment has two top rollers and one bottom-idler roller which transport the film in four loops. All rollers in the cabinet are idler rollers. Film enters at the bottom of the cabinet, adjacent to the wash tank. This cabinet has three hot-air plenums which are slotted on the surface adjacent to the film and are attached to the back wall of the cabinet by two locking bolts. The plenums are designed for easy removal and cleaning.

The drier blower and heaters are mounted at the back of the drier and supply hot air to the plenums through inlets in the back wall of the cabinet. This heated air is ejected from the plenums through horizontal slots to impinge on the film and remove moisture from both surfaces. Opening in the top of the cabinet provide exhaust for surplus air.

8. Drier Blower. A compartment at the back of the drier cabinet houses a centrifugal blower which is directly driven by a 3-horsepower motor. Air for the blower enters through an inlet at the back of the drier.
9. Drier Heater. Electric heating elements are mounted in a compartment at the rear of the drier. Makeup air for the drying compartments is forced over Finstrip heating elements which are wired in banks of three. The hot air is filtered by one fiberglass filter. Filter element is removable for replacement.
10. Operate the transport switch to "ON" and check that the vacuum transport roller operates smoothly from zero to maximum rpm.
11. Check that the module and recirculation pumps all operate satisfactorily.
12. Load the magazine with leader. Mount the magazine in place, and thread the processor. See Figure 2-6 for threading path.
13. Threading Procedure.
 1. Remove the upper exhaust covers and the plastic tank covers below these.

2. With the module pumps running, insert the 70mm width mylar threader provided into the splice box and hand thread it through all the modules, tanks, and the dryer. Mount the magazine loaded with leader or film as required. Prepare the end of the leader or film and splice as shown in Figure 2-7.

NOTE

The magazine should be loaded with sufficient leader at both the head end for threading and the tail end to prevent damage to the end of film.

14. Switch on the processor as directed and transport film over a range of speeds. Check for satisfactory mechanical performance.
15. Water for the wash module is provided by means of a fitting, located as shown in Figure 2-8. A regulating valve is provided in the supply line to the wash section to provide adjustment in the flow of fresh water.

2.4 FILLING OF TANKS

It is important to fill the tanks slowly and carefully at the correct locations in the tanks with a funnel. Figure 2-9. The tanks should be filled initially with the following quantities of solutions only:

- | | | |
|----|-------------------------|---------------|
| a) | #1 Developer Tank | 4-3/4 gallons |
| b) | #2 Short Stop | 2-1/2 gallons |
| c) | #3 Fix Tank | 4-1/2 gallons |
| d) | #4 Hypo Eliminator Tank | 2-1/2 gallons |

After the tanks are filled the pumps should be switched on. The liquid levels will fall, due to purging of trapped air and filling of pipe lines, etc. The tanks must then be topped up by use of the replenishment flowmeters.

2.5 REPLENISHMENT

Replenishment of the chemical solutions is achieved by maintaining the liquid level of the tanks during processing. This is achieved by the use of replenish flowmeters provided. Flow curves are provided, see Figures 2-10 through 2-13. These curves illustrate replenishment rates in cc/min. for each of the processing solutions.

NOTE

Valves must be closed when processor
ON switch is not engaged.

2.6 PROCESSING SPEED

When preparing for processing, the speed control should be set to the required film speed (fpm) on the dial, then checked for accuracy by means of a tachometer operated from the main drive capstan.

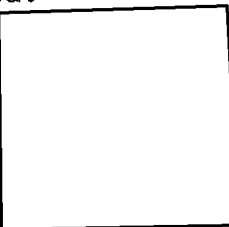
2.7 PROCESSOR EXHAUST

The exhausting of the air from the processor modules may be accomplished by one of two methods. The module covers incorporate both a light sealed exhaust slot and an exhaust pipe connection spigot. If the exhaust duct provided is installed, the sealing plates fitted over the exhaust slots should be retained. If the exhaust duct is not used, the sealing plates should be removed. See Figure 2-14.

SECTION 3
SENSITOMETRIC DATA

3.1 FILM PROCESSING PARAMETERS

1. The following film types in widths of 70mm to 9-1/2 inch may be processed.

- STAT
- | | | |
|----|---|---|
| a) |  | Plus-X Aerial (ESTAR thin Base) |
| b) | | High Definition Aerial Film (ESTAR Thin Base) |
| c) | | Aerographic Duplicating Film (ESTAR Base) |
| d) | | Five Grain Aerial Duplicating Film
(Triacetate Base) |

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2. The sensitometric performance of the processor is based on the closest possible match to standard samples of each film exposed and tray processed per manufacturers standards

3. Reference film sample exposure data.

STAT The following exposing data was used for both the reference and [] film samples:

1. Instrumentation used:

STAT [] sensitometer, []

STAT Step tablet []

STAT Filament [] Meter Candles-203000-Amp. Setting 7.13

a) [] N.D. filter, 2.40 - color correction filter, [] exposure time - 1/50 sec. STAT

b) [] N.D. filter, 1.00-color correction filter [] exposure time - 1/50 sec. STAT

c) [] N.D. filter, 1.80 - color correction filter, none - exposure time- 1/15 sec

d) [] N.D. filter, 1.10 - color correction filter, none - exposure time - 1/15 sec

4. Sensitometric film samples of each type, in each of the two widths, may be prepared in accordance with Figure 3-5. These samples may be used in evaluating the following parameters:

- 1) Gamma
- 2) Photographic Speed
- 3) D. min. - D. max.
- 4) Development uniformity edge to edge
- 5) Complete Fixation (sod sulfite test)
- 6) Archival Quality per ASA PH 1.28-1957

3.2 CHEMICAL FORMULATIONS

1. The developers used in this processor are a modification of the Navy Rapid Developer, NRD-29 and NRD-40, and proprietary chemistry. The prototype has been designed on the basis of the results obtained in the breadboard in Phase I with this chemistry.

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2. The formula for NRD-29 (Navy Rapid Developer for Aerial Film) as used in the testing is as follows:

Water 100°F	750.0 ML
Metol	5.0 grams
Sodium Sulfite, Des	50.0 grams
Hydroquinone	20.0 grams
Sodium Hydroxide	10.5 grams
Potassium Bromide	8.0 grams
Benzotriazole	0.2 grams
Water to Make-Up	1.0 liter
pH; 11.02 at 70°F	

3. The formula for NRD-40 (Navy Rapid Developer for Aerial Film) as used in the testing is as follows:

Water 80°F	750.0 ML
Metol	8.0 grams
Sodium Sulfite, Des	50.0 grams
Hydroquinone	12.0 grams
Sodium Hydroxide	9.0 grams
Potassium Bromide	2.5 grams
Benzotriazole	0.2 grams
Water to Make-Up	1.0 liter
pH; 11.17 @ 70°F	

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Anti-foam 0.50 ml/l must be added to the developers and stop bath.

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4. Stop bath 5% solution acetic acid.
5. proprietary chemistry

Fixer
 Hypo Eliminator

3.3 FILM PROCESSING

1. The processor is to be operated for each of the specified film types at the temperature and processing rate given for the particular film, in the table of experimental parameters and results below.

EXPERIMENTAL PROCESSING PARAMETERS & RESULTS

STAT

	Transport Speed (fpm)	Developer	Process Temp (All Tanks)	Drier Temp	Sensitometric Results
	11	NRD-29	110°F	160	Fig. 3-1
	10	NRD-29	100°F	160	Fig. 3-2
	20	NRD-40	110°F	120	Fig. 3-3
	25	NRD-40	110°F	120	Fig. 3-4

2. Figures 3-1 through 3-4 show a sensitometric comparison of film samples processed in NRD-29 and NRD-40 developers and their relationship to reference samples tray processed in accordance with film manufacturers recommendations.

STAT

3. Drier Parameters. To achieve optimum film drying, based on results, the processor environment should be maintained at 70°F ± 2°F and R.H of 45% ± 5%.

SECTION 4

MAINTENANCE INSTRUCTIONS

4.1 PROCESSOR ARRANGEMENT

The main components, access panels, wiring assemblies, etc. are shown in Figure 4-1 through 4-13.

4.2 CLEANING

1. All external surfaces are polished stainless steel or plastic covered. General cleaning discipline is important to the successful operation of the processor. Before processing film, the processor should be cleaned with a vacuum cleaner using a soft brush attachment. Smudges and fingerprints may be removed from the surfaces with a soft sponge moistened with a mild detergent.

2. Clean all rollers in the load magazine, splice box, squeegee assembly, dryer and the vacuum roller with clean warm water in which a very small amount of detergent has been added. Dry off all rollers with clean compressed air, to avoid lint from cloths.

3. Replace air filters as required.

4.3 LUBRICATION

The processor has been designed for minimum need of lubricating grease or oils. All dryer bearings must be lubricated as required. Blower motor and scowell must be lubricated every 500 hours of operation. The speed reducer portion of the film transport vacuum roller drive motor, should be lubricated with light oil every 1000 hours of operation.

4.4 ADJUSTMENTS

The need for sensitive adjustments has also been eliminated in this processor, but means are provided for regulating the following:

1. Liquid flow into modules. An adjustment throttle (See Figure 4-2) is provided in the pressure feed line from each pump to the corresponding module. This adjustment has been factory preset to give the optimum performance for the specified types of film.

2. Solution temperature control. The temperature control system is comprised of two systems.

Solution temperature control is achieved by means of two separate thermostats. One thermostat is preset at 110°F. The other is variable and may be adjusted to suit any particular film requirement. Either 110°F or variable control can be selected by means of the switch provided. See Figure 2-4.

4.5 DISASSEMBLY AND ASSEMBLY

This processor is of compact unit construction consisting of one component only. All assemblies and items of equipment may be removed in a straight forward logical manner, as detailed below and shown in Figure 4-1, etc.

1. Magazine. The magazine is mounted in place as shown in Figure 4-9, and is automatically locked into position and the magazine light trap opened.

CAUTION

The splice box cover must be closed when mounting magazine, to prevent fogging of the film as the light trap opens.

2. Splice Box. One adjustable splice plate is provided for 70mm and 9-1/2 inch wide film. The splice plate is installed by simply positioning on two locating studs. The roller over which the film travels out of the splice box lifts out of its end housings.

3. Cover and Access Panels. All cover access panels are removable without the use of special tools as follows:

- a) Splice box cover. This is not removable and is hinged along the rear edge.
- b) Exhaust hoods. Thses contain light traps and exhaust the air used by each [] module. They lift off the top of the machine.
- c) With the exhaust hoods removed, the tank covers and inserts may be lifted out for access to the tanks.
- d) Top panels. (left and right). These are finishing panels and lift off directly, giving access to the air feed duct into each side of the [] modules. Those in the left hand side panel are provided with inserts for the solution replenishing system.
- e) Side panels. Two panels are provided for each side of the processor and may be removed by lifting and pulling out the bottom edge. The left side panels give access to the main drain trough, filters, pump connections and temperature control thermostats. The right side panels give access to the main electrical connection assemblies.
- f) A removable door below the takeup gives access to the electrical panel containing the terminal strip connectors for the two main switch panels. The vacuum pump for the vacuum roller, and the drive motor controller and the temperature controller are also mounted in this compartment, See Figure 4-6.

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4. Component Removal.

- STAT
- a) The impingement modules may be removed for cleaning or examination by removing the appropriate square access panel in each side main air duct, and releasing the four bolts holding the connector in the module ends. The pipe connection from the pump into the moduel on the left side of the machine should next be removed. The module assembly itself may now be taken out after removing the four bolts and securing it on each side, See Figure 4-7.

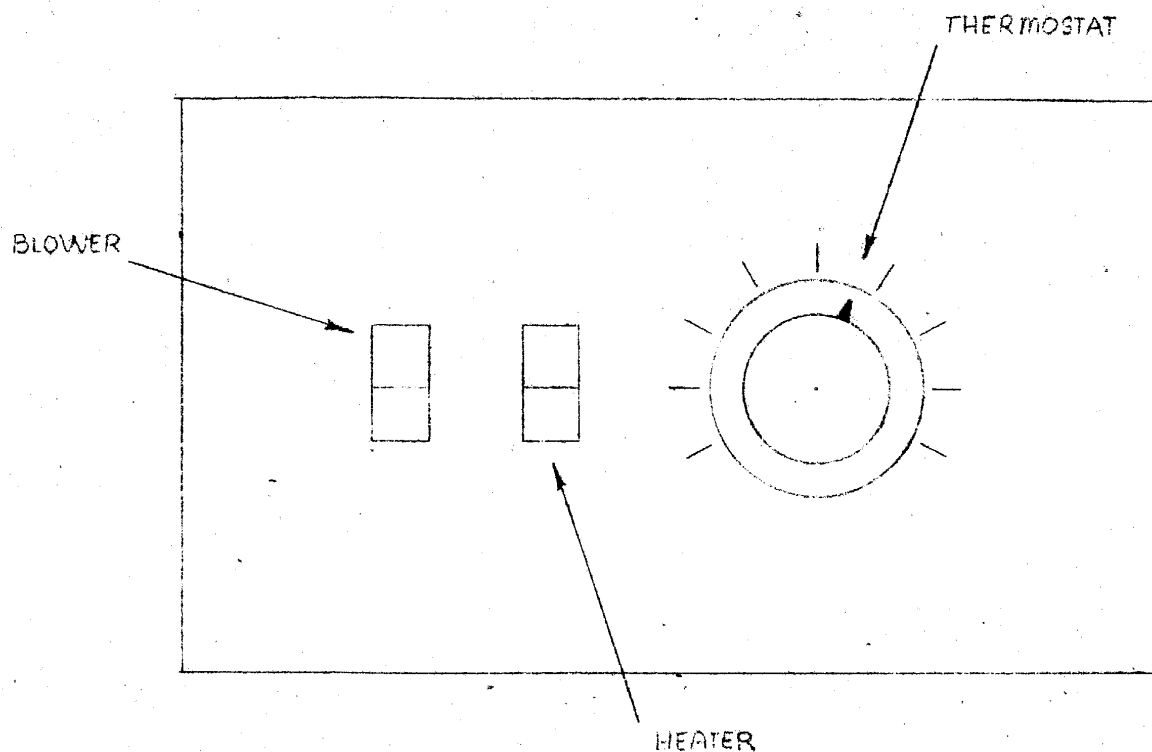
The agitation plenum in the tank of the development and wash section only may be removed by disconnecting the center of the three connections from the pump, below the tank, removing the two screws securing the plenum in the tank, and lifting it out. See Figure 4-10.

- b) The vacuum roller drive motor is located behind the panel on which the speed control is mounted. The panel may be removed after extracting the four holding screws, See Figure 4-8.
- c) The takeup spool drive motor is mounted in the compartment below the drive motor compartment. Access to the compartment is gained by removing the five screws securing the cover. The friction clutch on the spool drive shaft is also accessible for adjustment, by removing front plate.

- d) Access to the temperature control boxes is by removal of the two left side access panels. On each control box a switch is provided to select 110°F or the variable temperature from 85°F to 110°F.
- e) Main Air Blower. The air blower is located in the compartment below the magazine and splice box. Access for inspection is obtained by removing the entire top as shown in Figure 4-3. Auxiliary heaters (2) are located in main air blower duct to stabilize temperatures in each tank if condition is required.

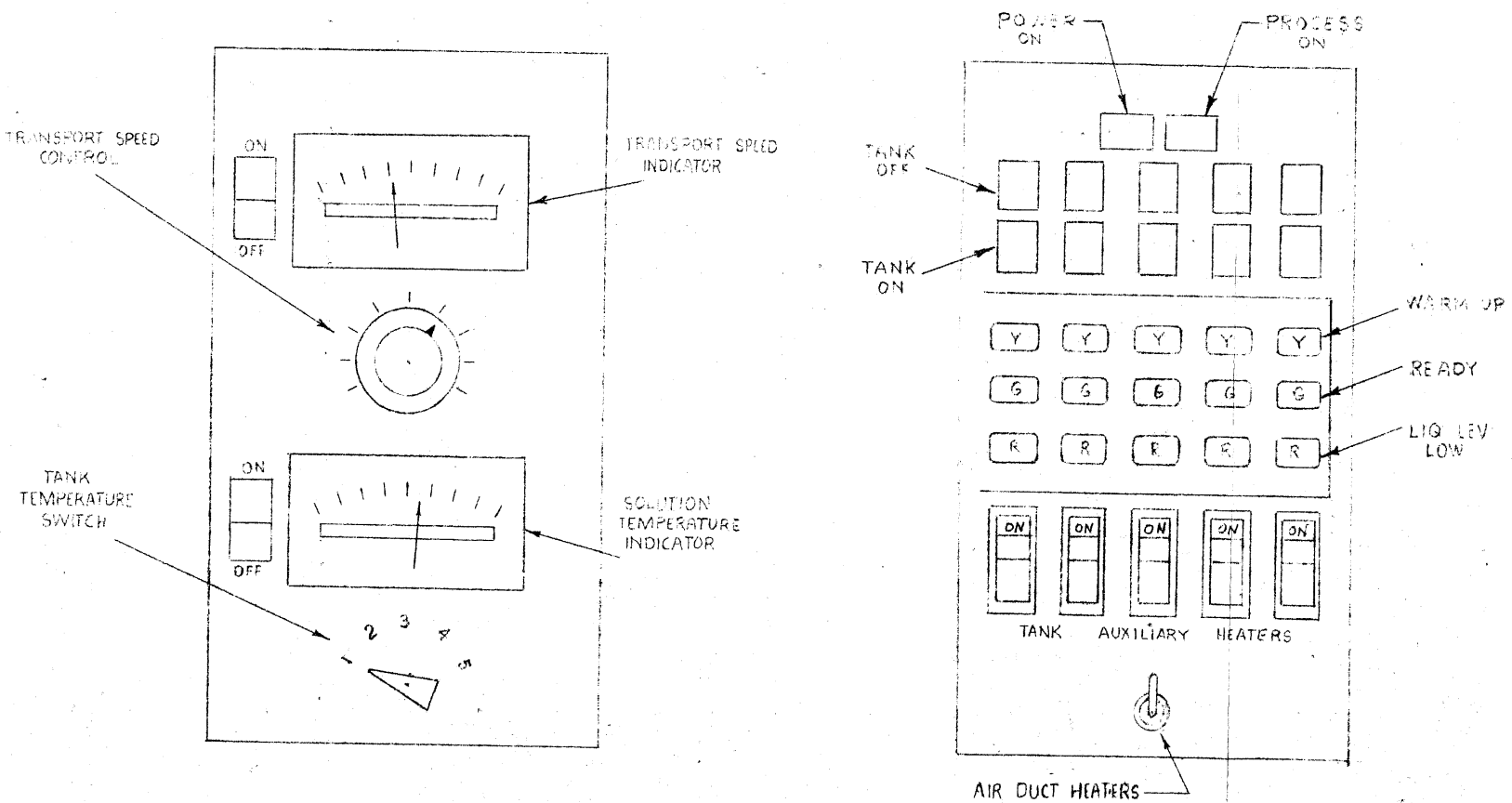
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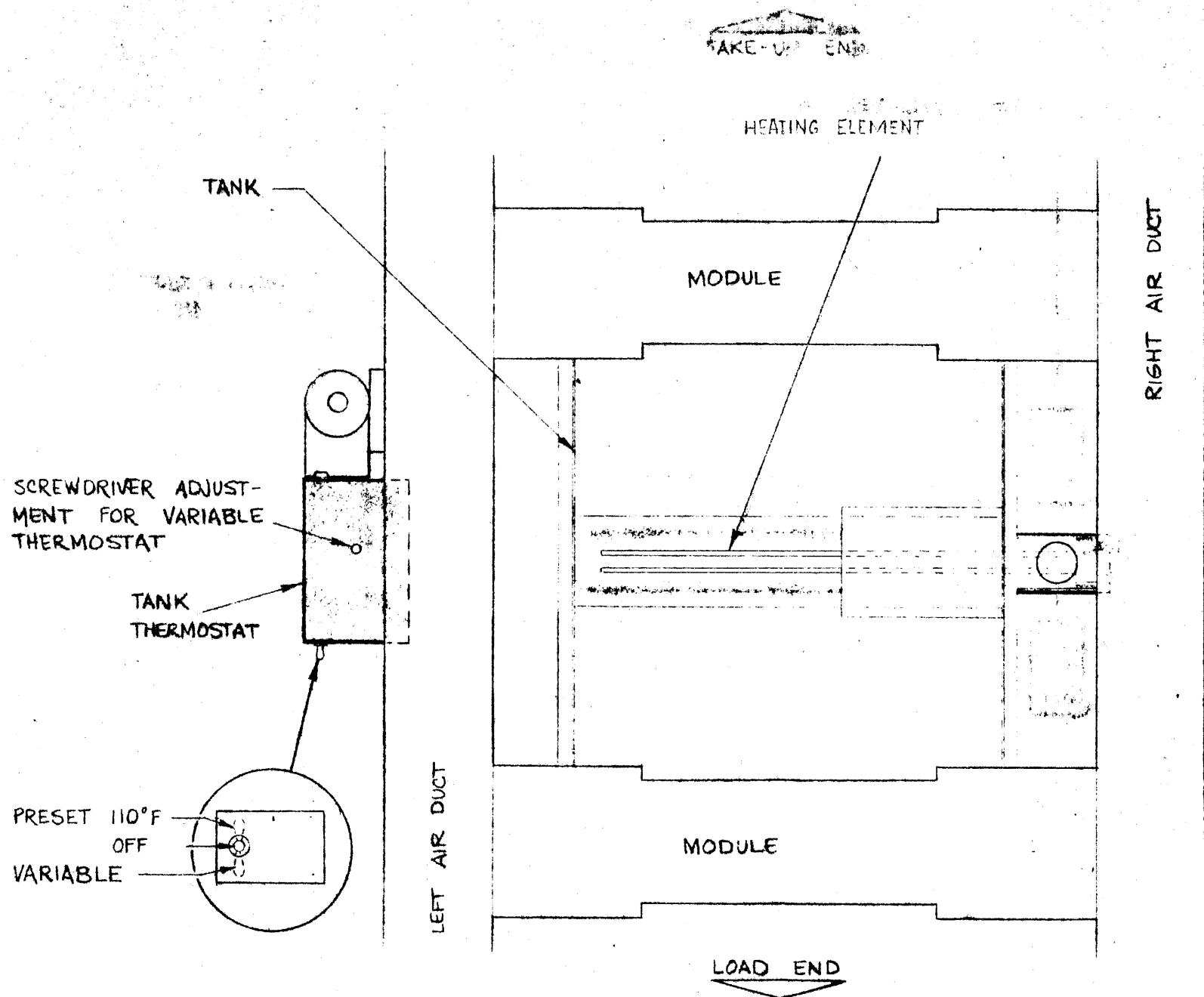


CONTROL PANEL

FIG. 2-3



CONTROL PANELS
FIG. 2-3



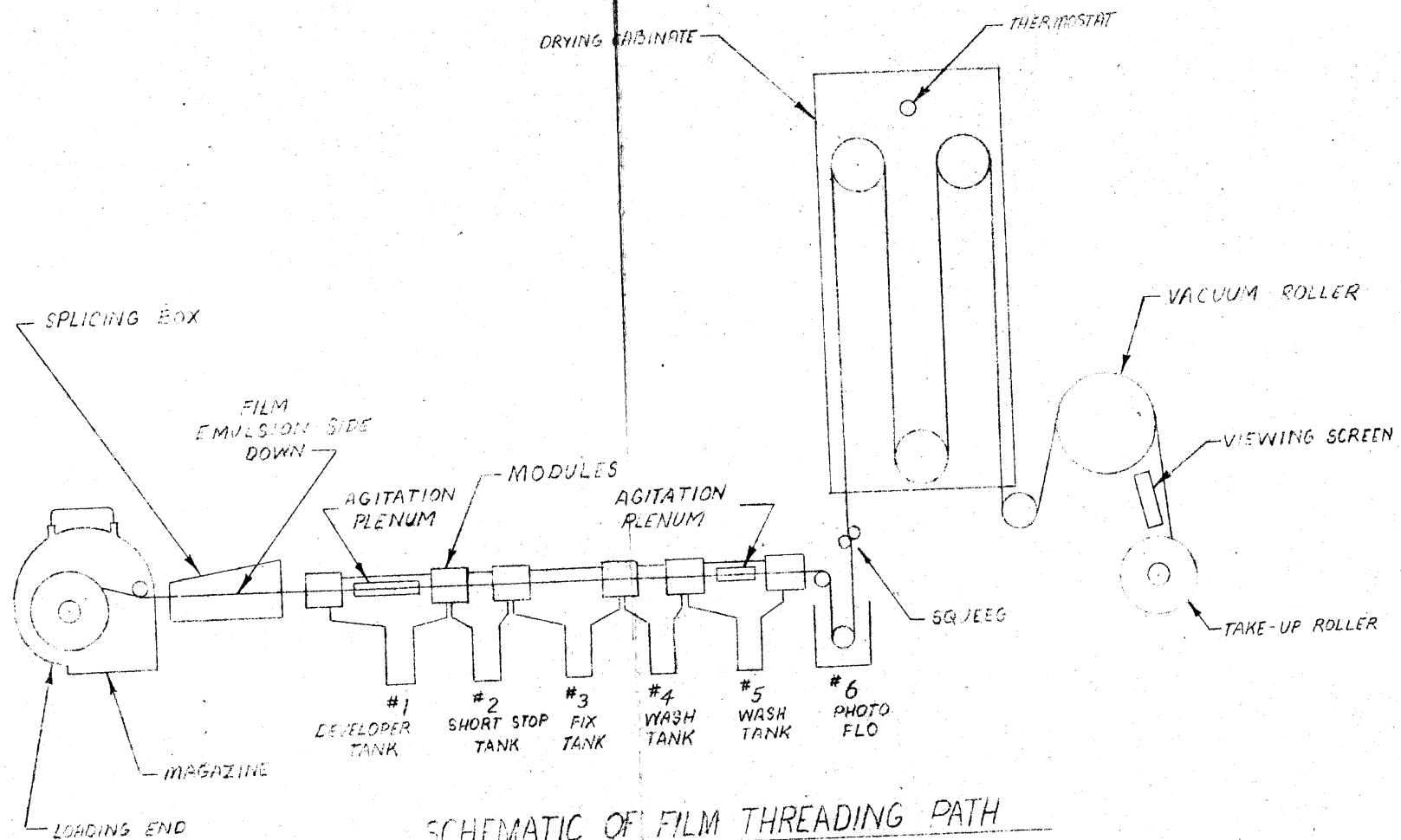
PLAN VIEW OF TYPICAL TEMPERATURE CONTROL ADJUSTMENTS

Fig 2-4

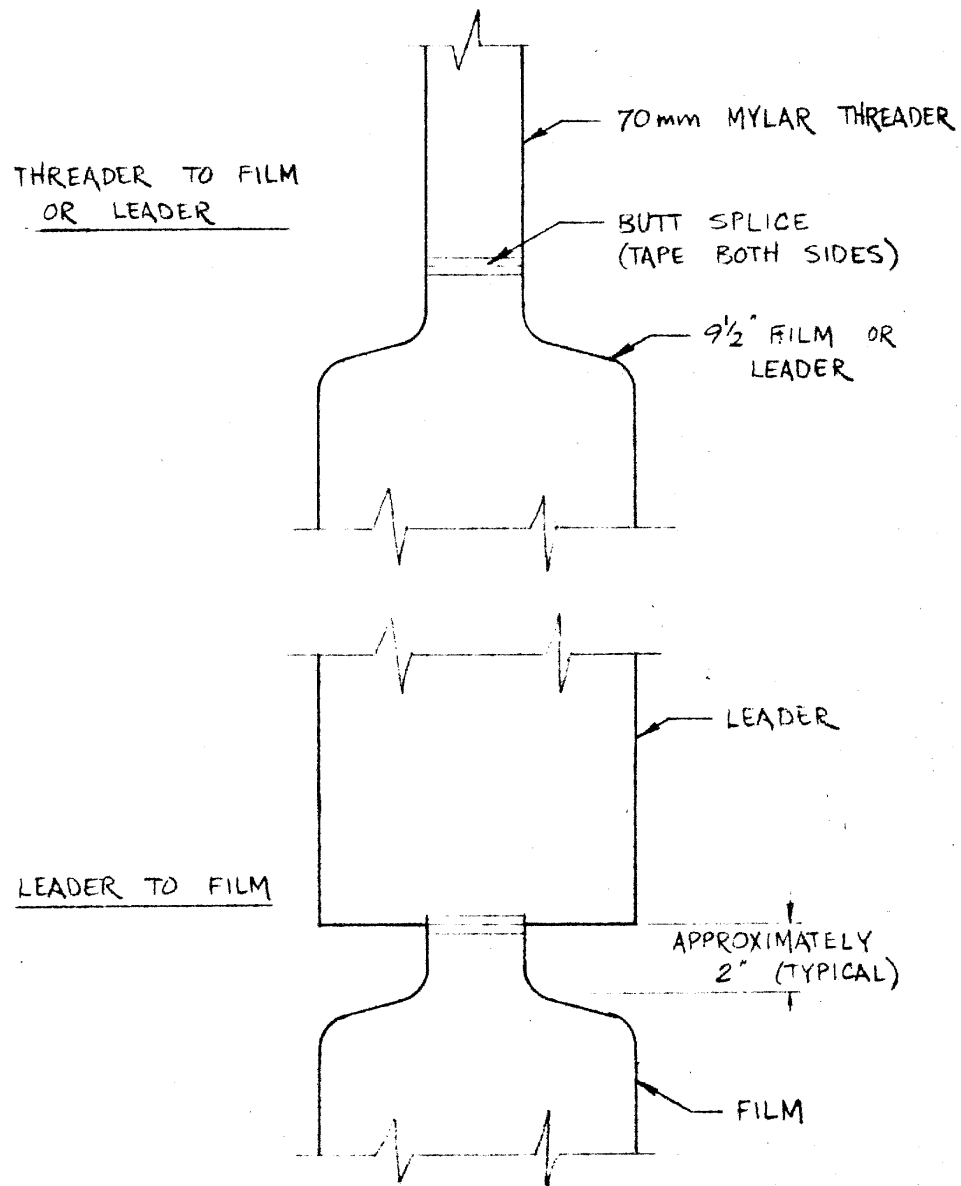
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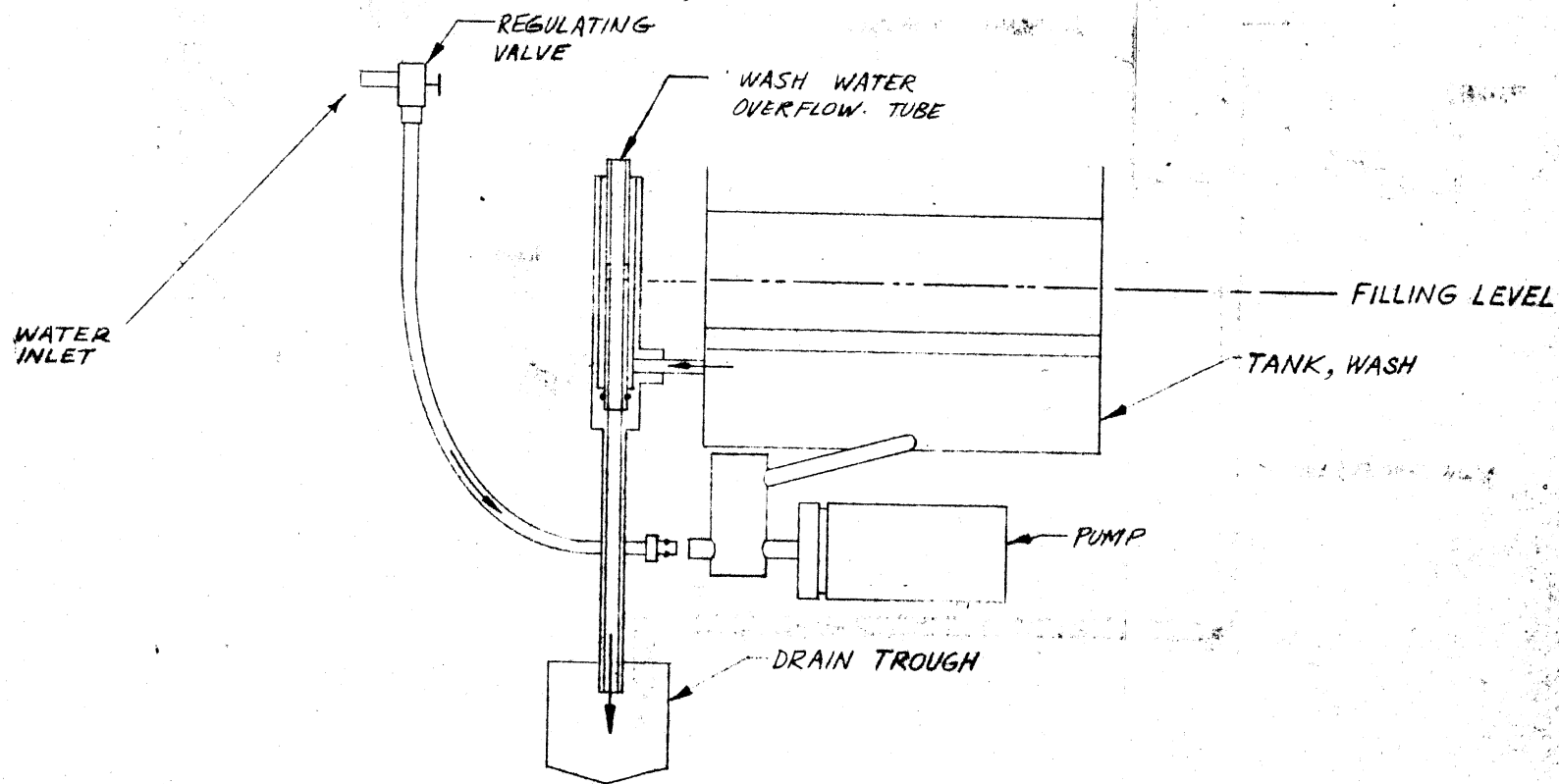
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SCHEMATIC OF FILM THREADING PATH
FIG. 2-6

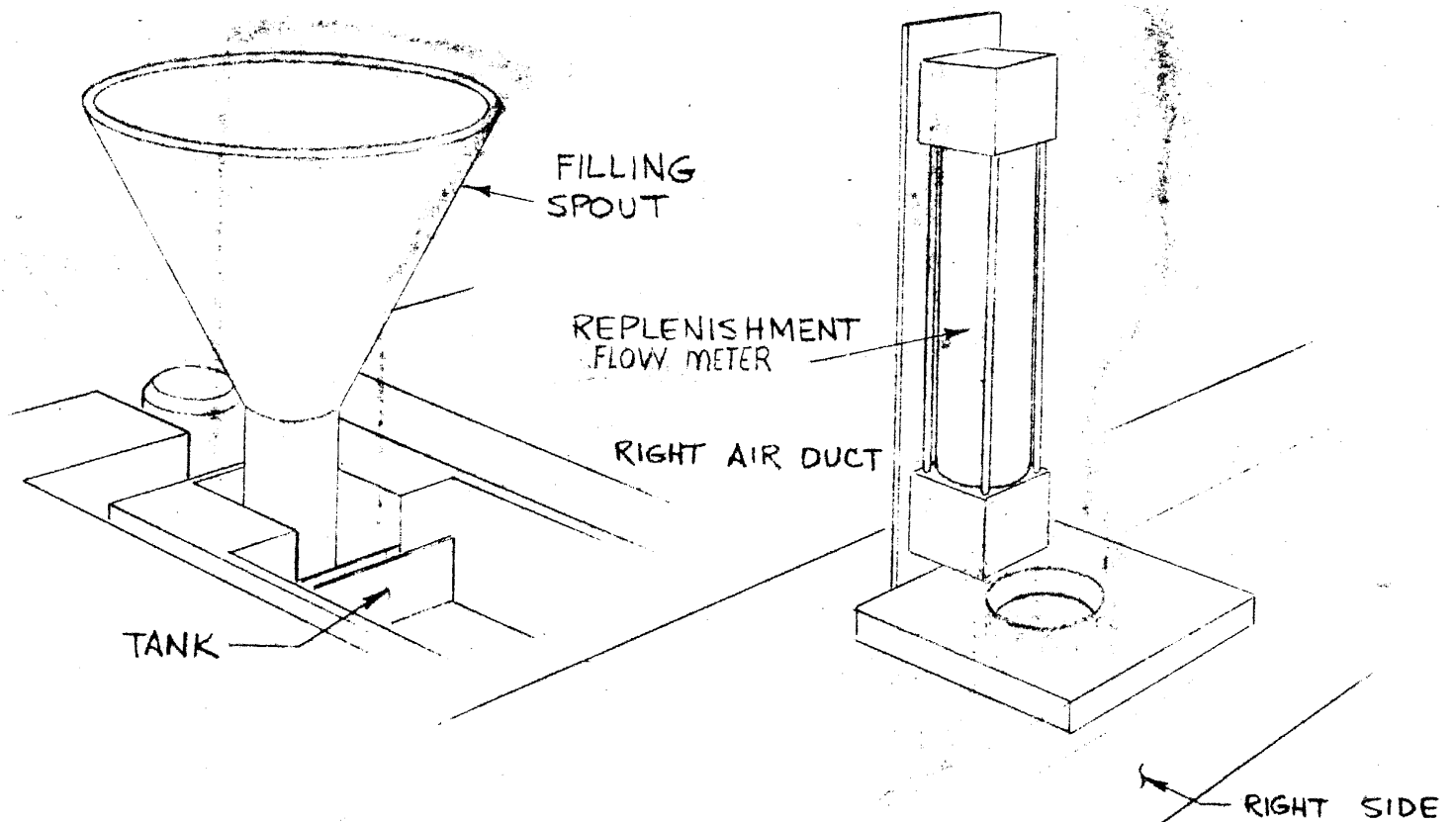


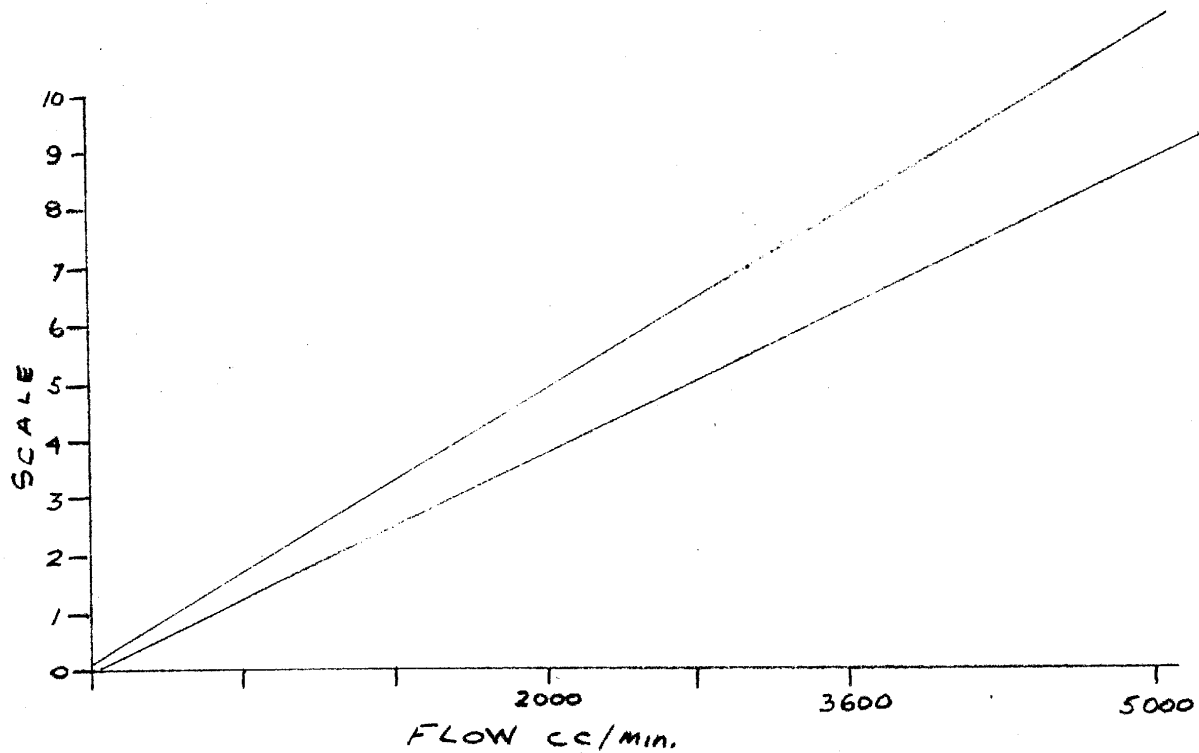
SPLICING TECHNIQUES



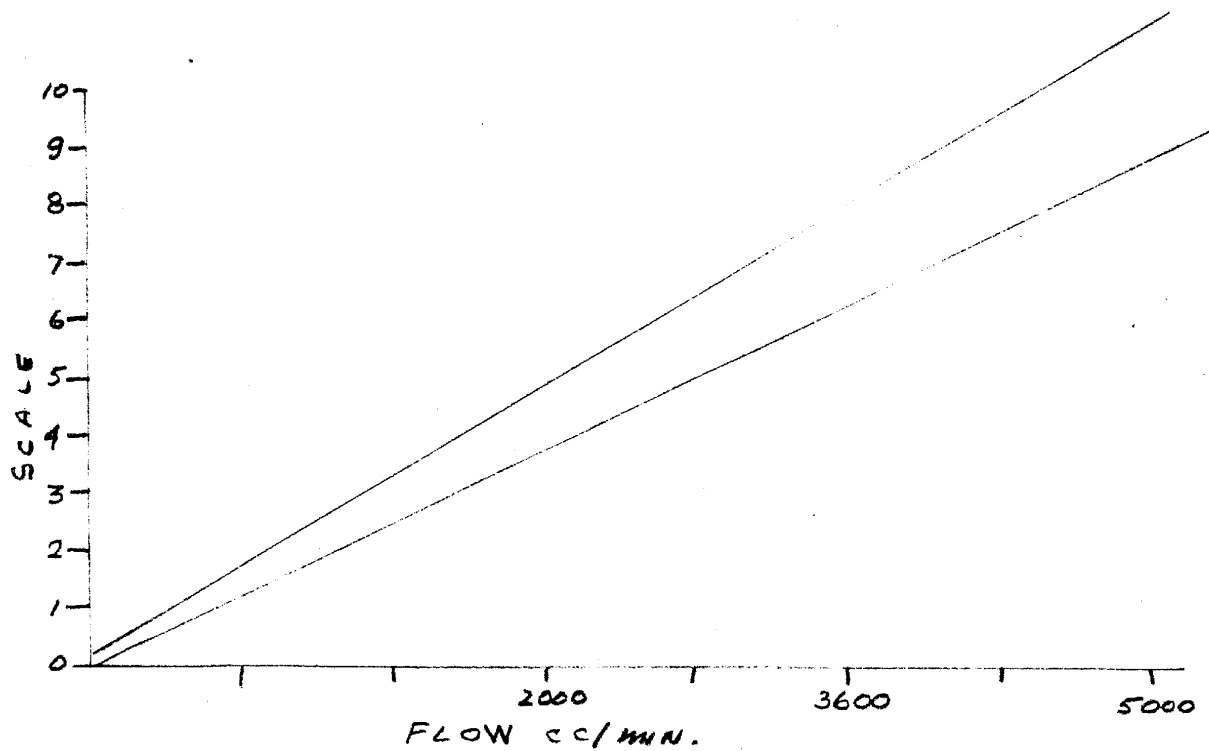
WASH WATER SYSTEM

FIG. 2-8

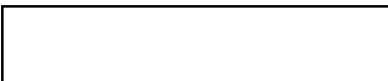


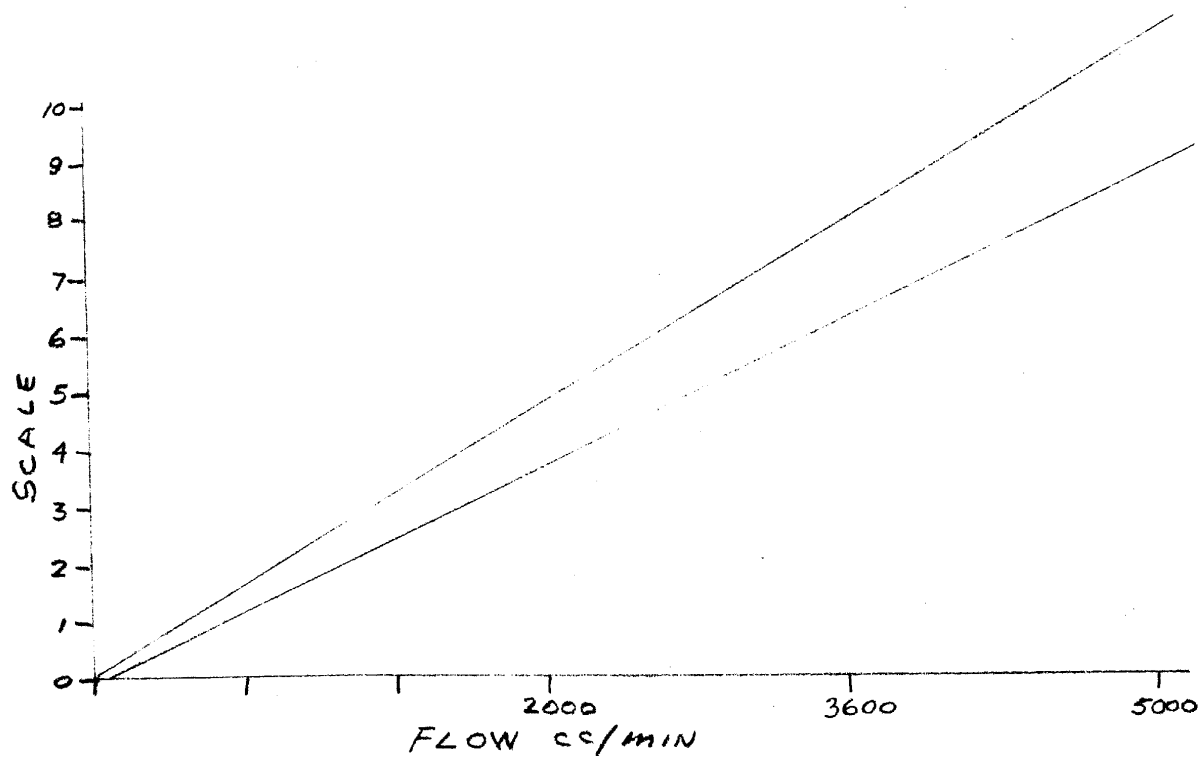


MEDIA: WATER



MEDIA: WATER





MEDIA: WATER

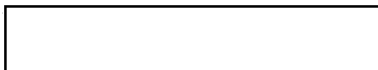
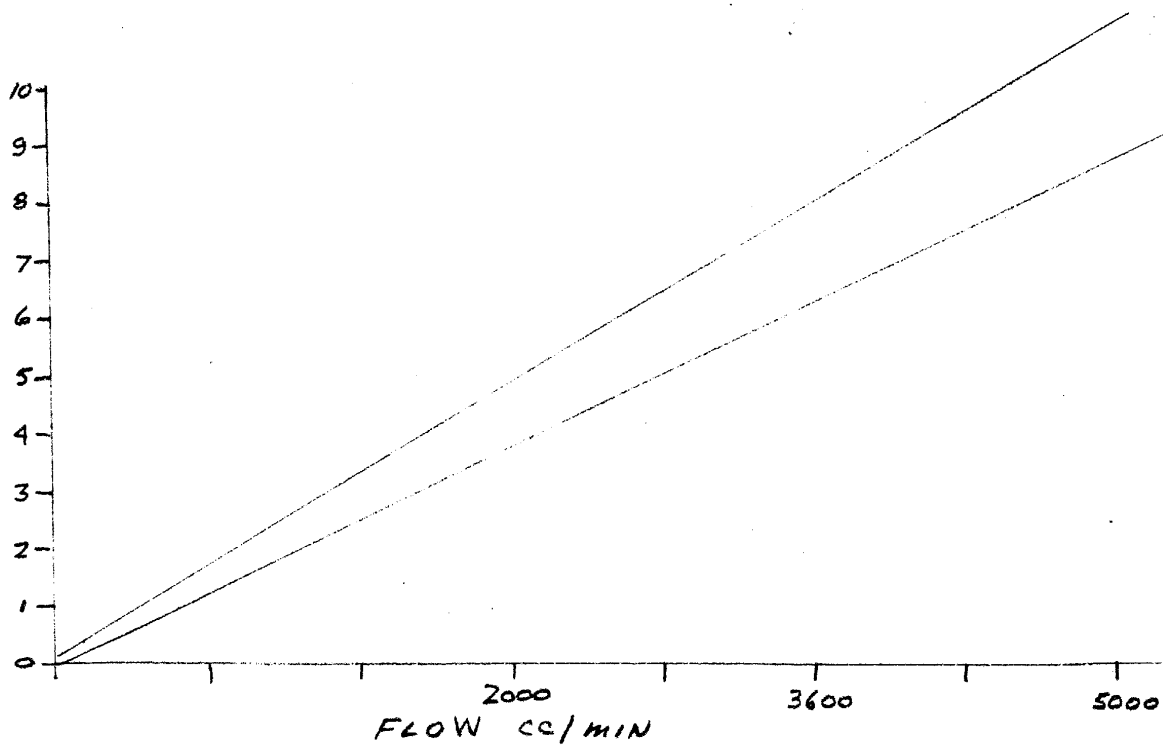
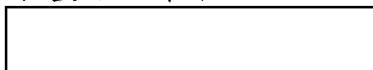


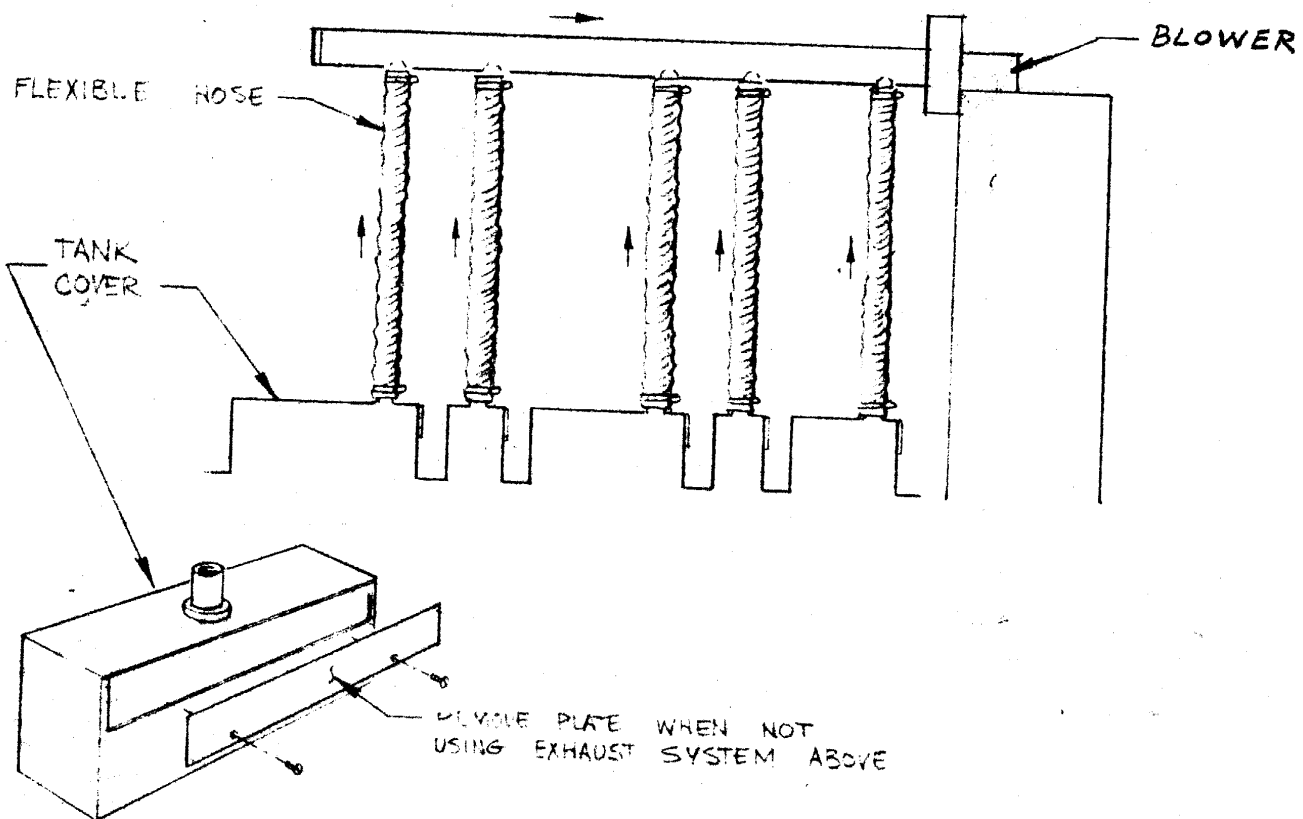
FIG 2-12
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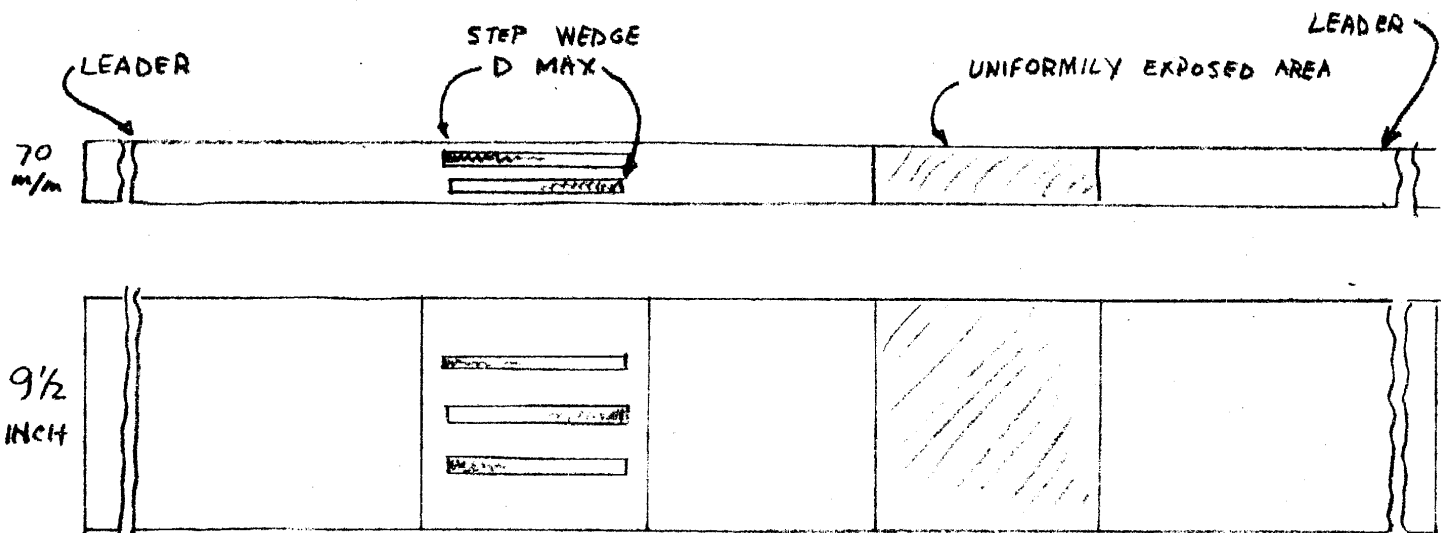
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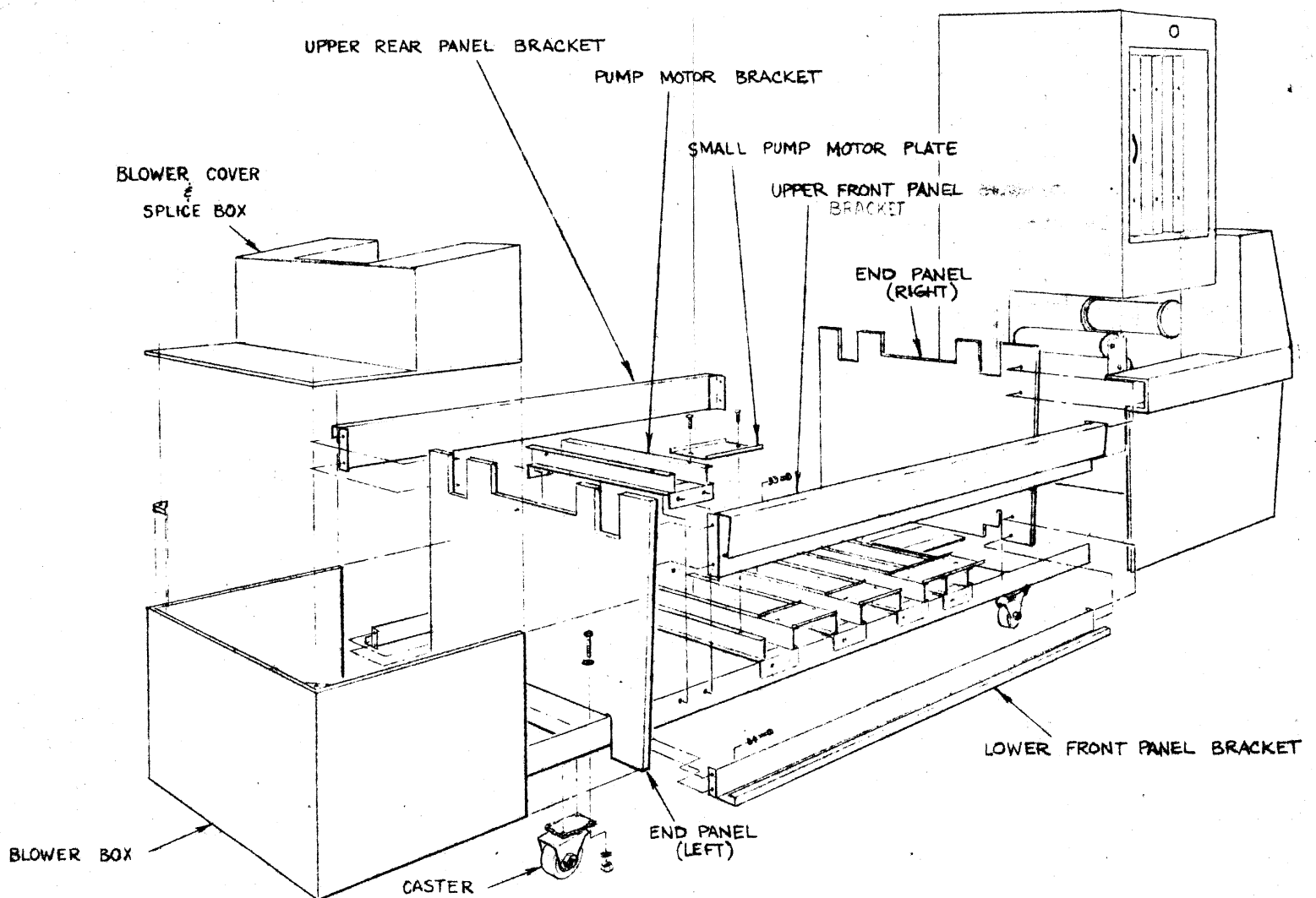


PROCESSOR EXHAUST



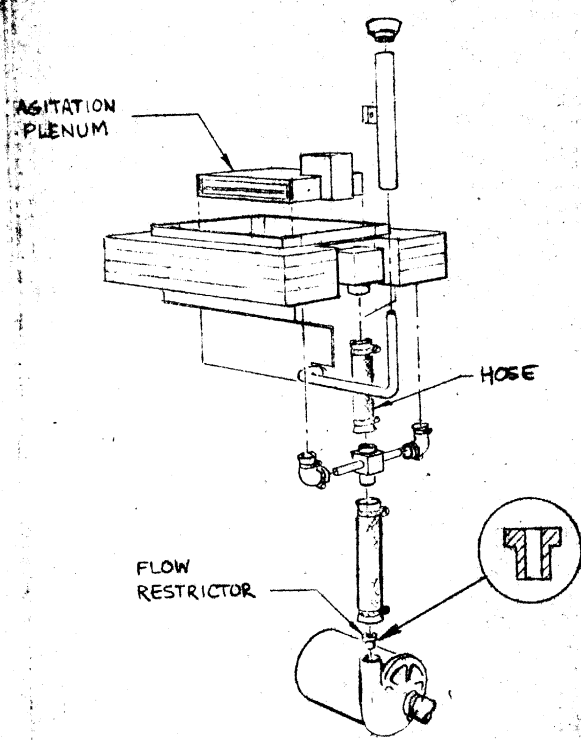
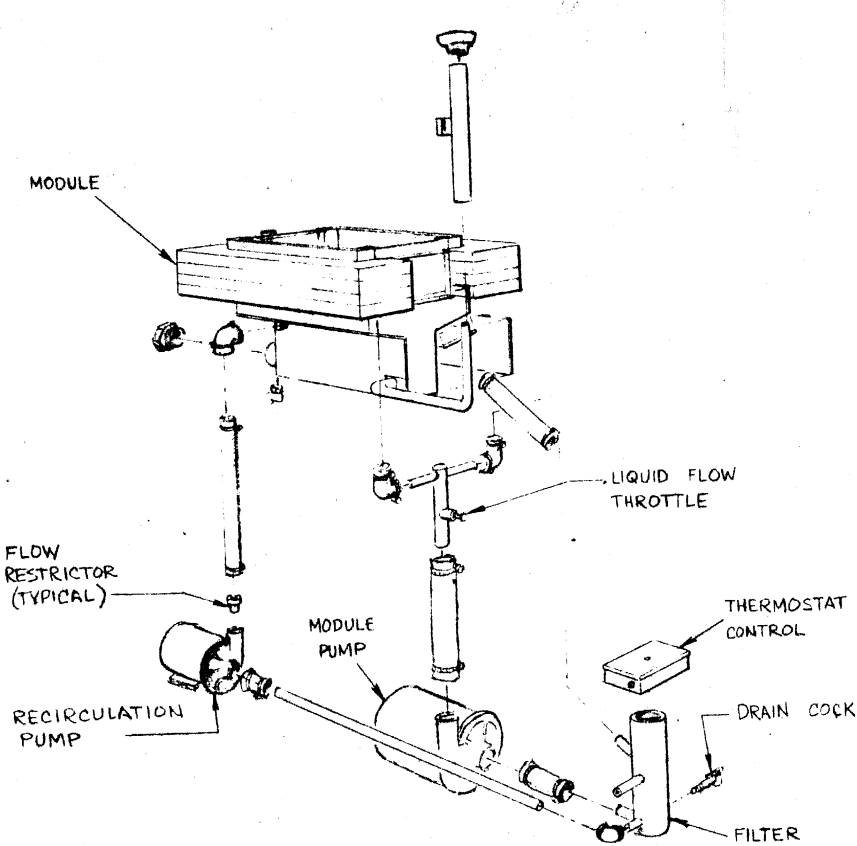
TEST SAMPLES

F/6 3-5



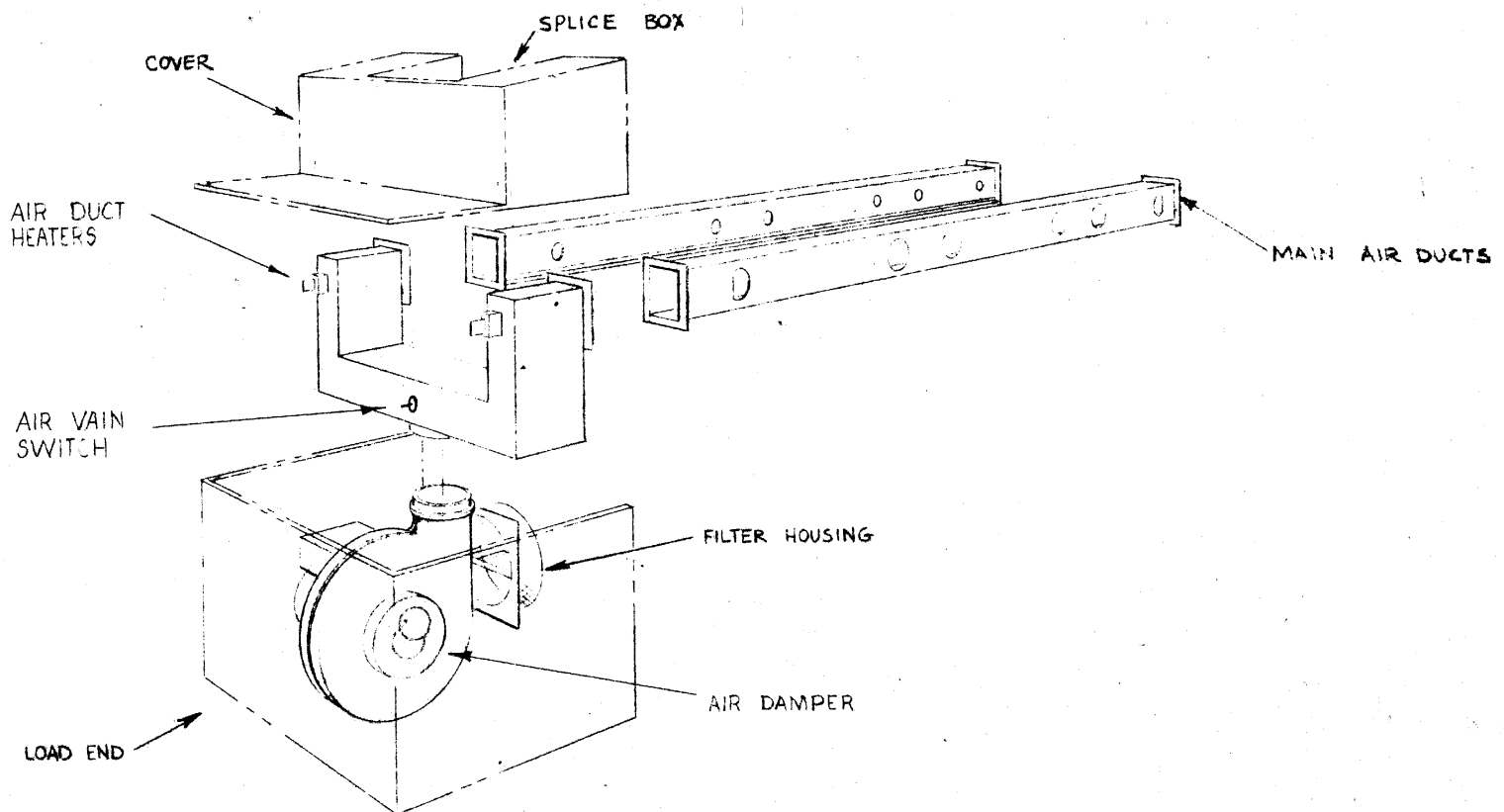
FRAME ASSEMBLY

FIG. 4-1

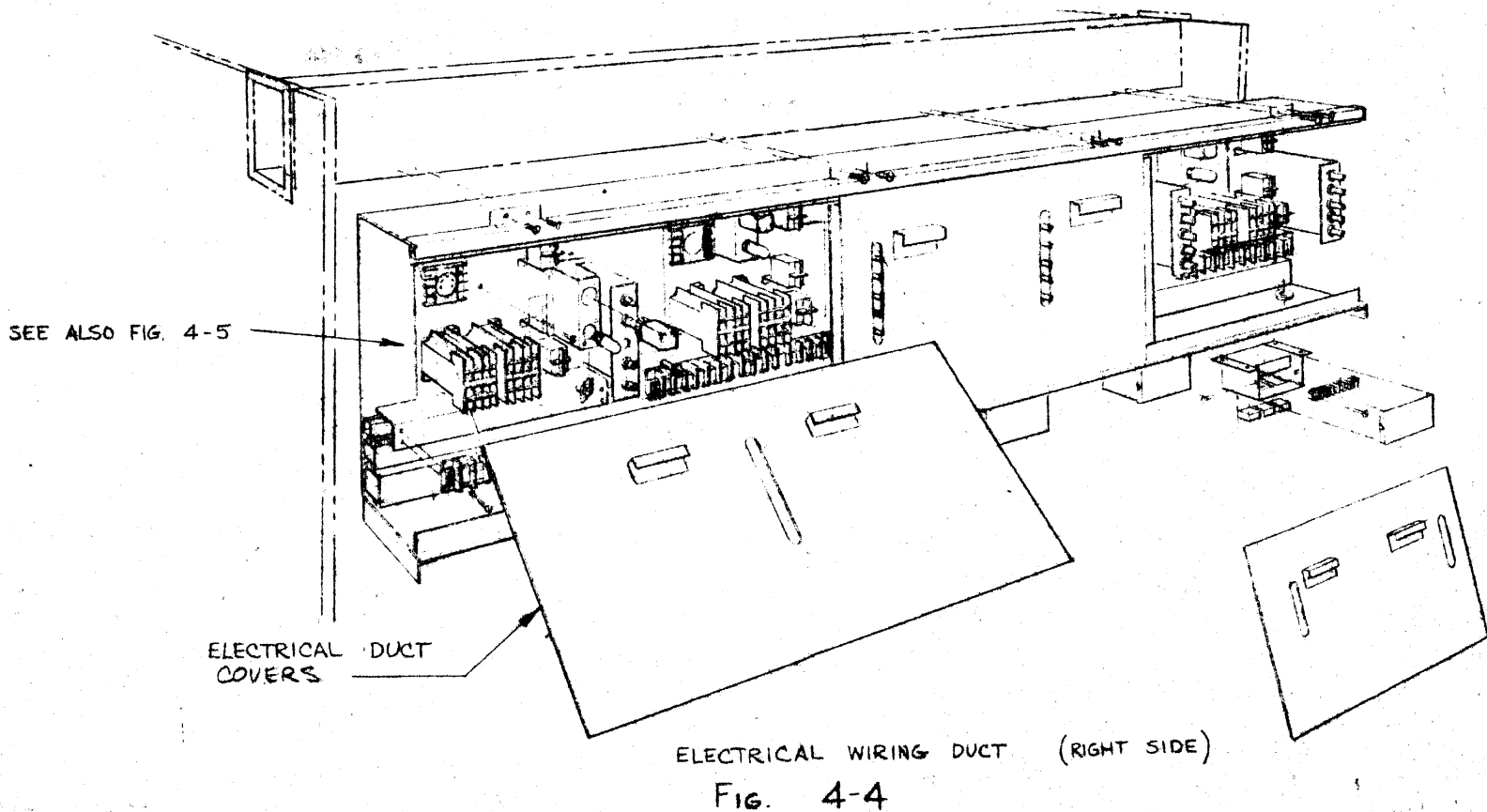


DEVELOPMENT & WASH TANKS ONLY

TANK, MODULE AND PLUMBING ASSEMBLY
FIG 4-2



BLOWER, AIR FILTER AND DUCT ASSEMBLY
FIG 4-3



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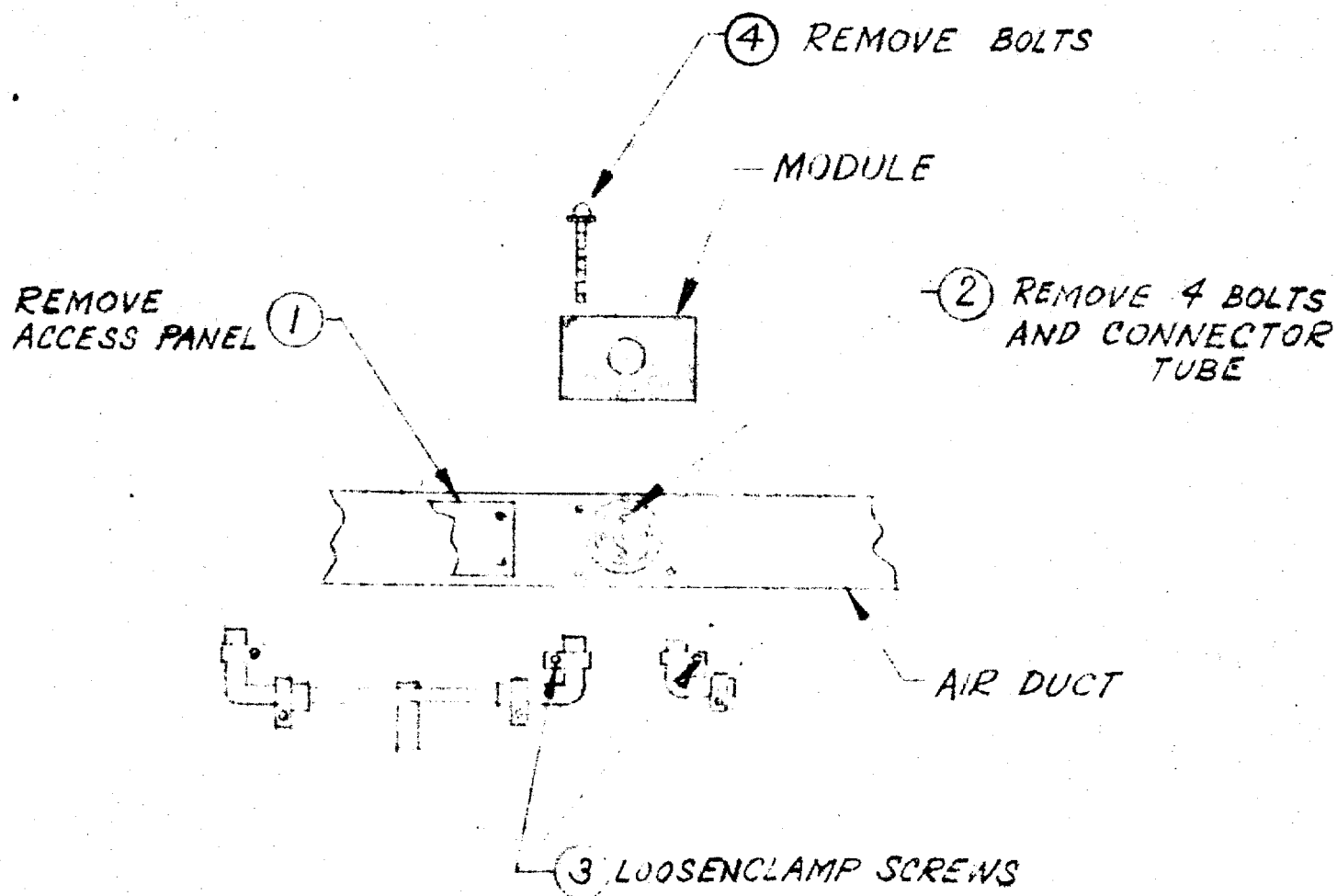
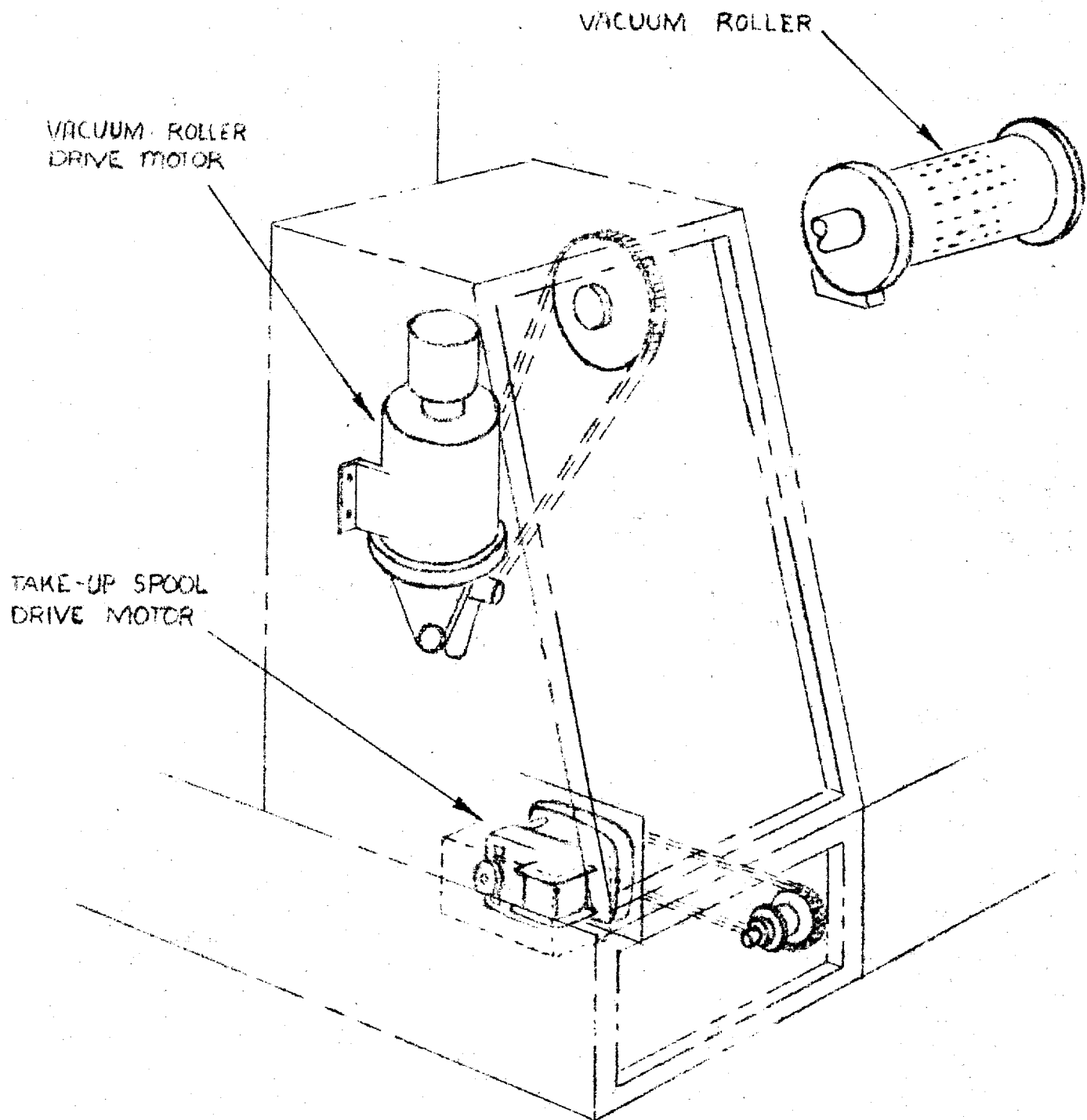


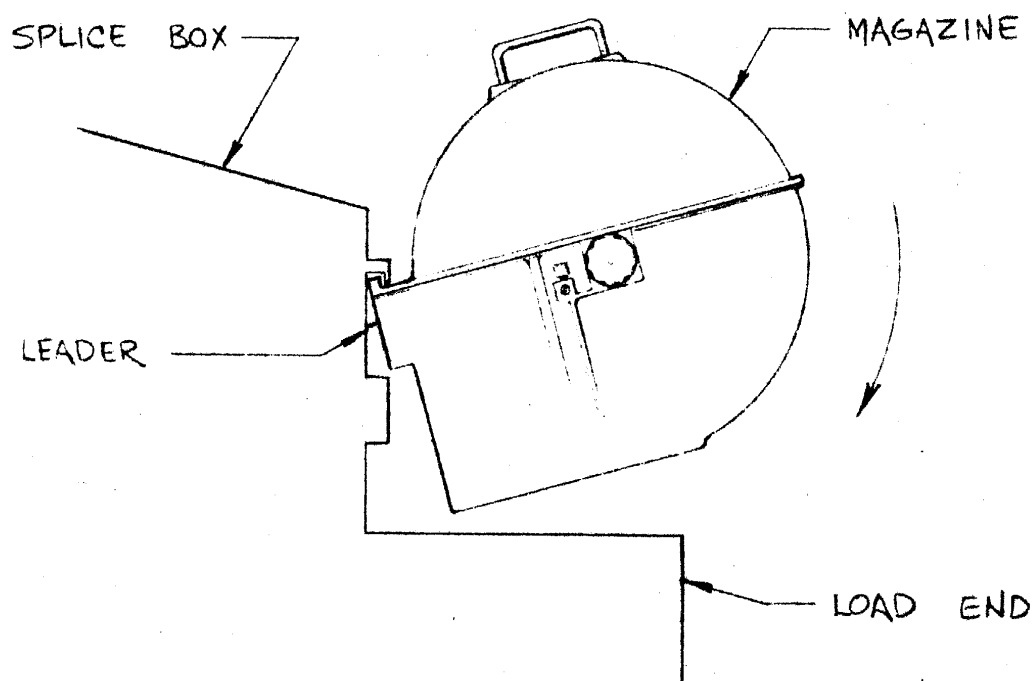
FIG. 4-7

REMOVAL OF MODULE



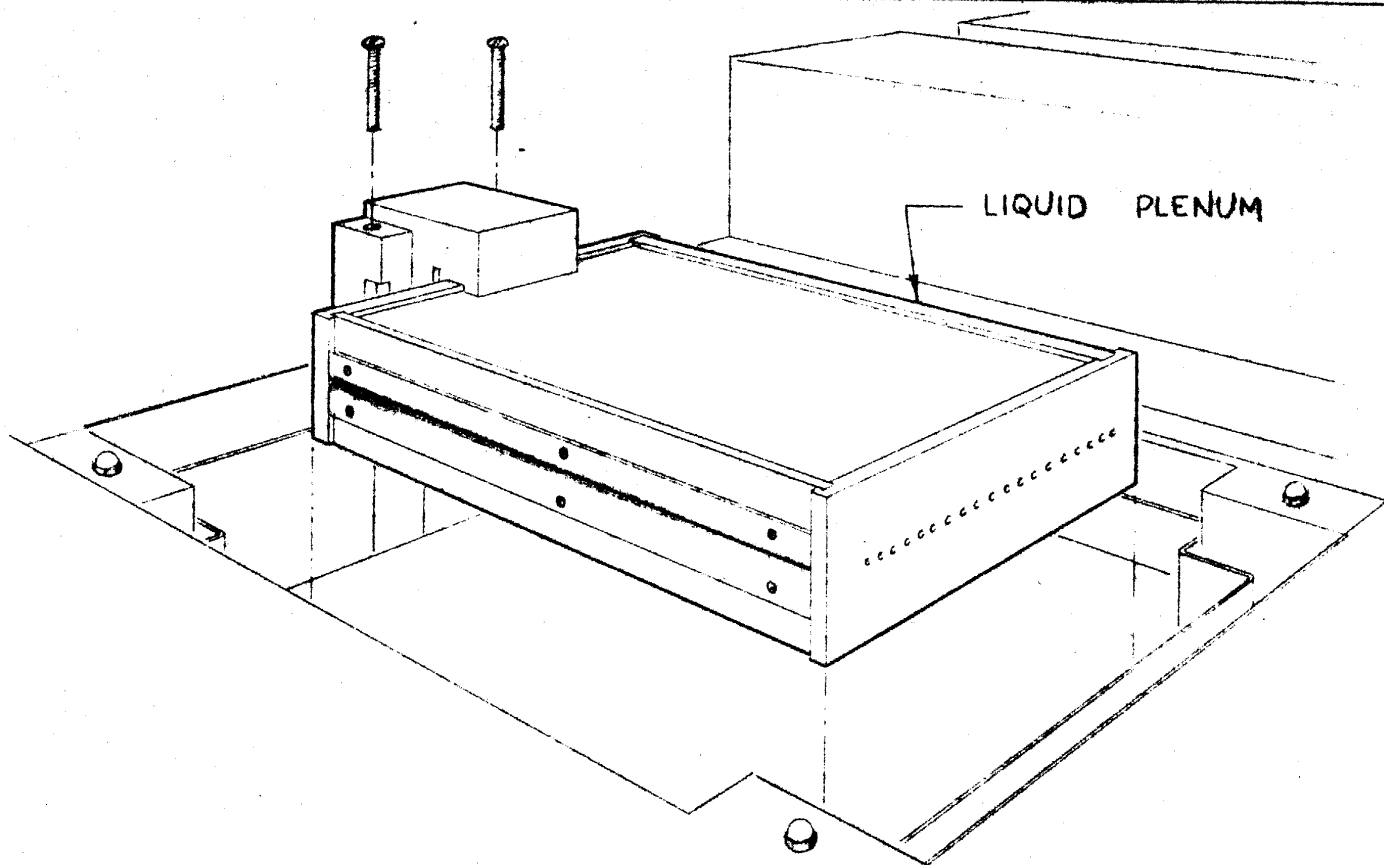
VACUUM ROLLER AND TAKE-UP SPOOL
DRIVE MOTORS

FIG 4-8



MAGAZINE INSTALLATION

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REMOVAL of AGITATION PLENUM

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FIG. 4-10

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